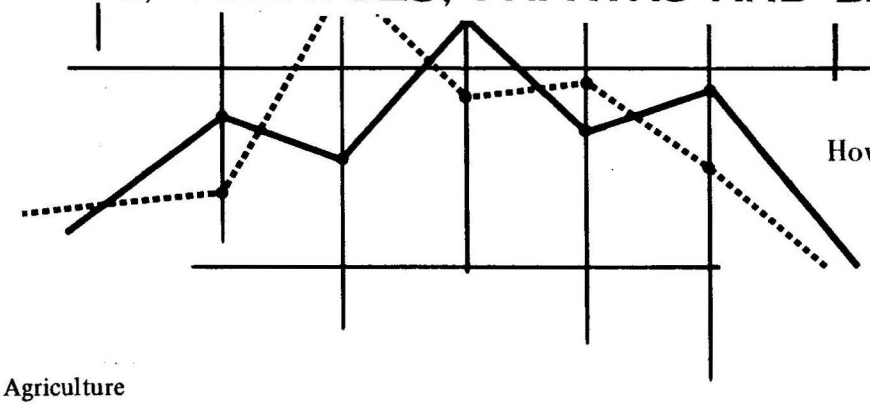
HONOLULU MARKET PROJECTIONS FOR SELECTED DIVERSIFIED CROPS:

SNAP BEANS, CUCUMBERS, GREEN ONIONS, GREEN PEPPERS, TOMATOES, PAPAYAS AND BANANAS



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This paper is the second in a series of three that report results of a statistical supply-demand analysis of a selected group of crops sold on the Honolulu market.[1] The present paper discusses Oahu vegetable crops that occupied fewer than 100 but more than 10 acres of land during 1971 and two island orchard crops. The projections assume no significant changes in technology or State agricultural policy other than those trends already established or recognized in the following text. The estimates are based on a statistical analysis of historical data covering the 22-year period ending in 1971 and are projected to 1980. Values calculated from the functions for certain commodities which appear to be overly optimistic or pessimistic in terms of recently observed trends are reevaluated. In these cases projections are based on a combination of factors including the estimated equation, recent trends, and the author's judgment.[2] The estimated functions and related tests of significance are given in the statistical summary.

The complete functions and related statistics are given in the statistical summary. Projected market components and the variables used in estimating them are listed below:

1. Honolulu market demand—estimated from total quantity marketed, population, and income variables in all cases except for green onions, which includes a price variable.
2. Honolulu market supply grown on Oahu—estimated from quantity marketed from Oahu, Honolulu wholesale price, and the ratio of farm-to-contract construction wages (based on wage series reported by the Hawaii State Department of Labor and Industrial Relations).
3. Honolulu market supply grown on the neighbor islands—functionally identical to Oahu-grown supply except for the quantity variable.
4. Imports are estimated as the difference between Honolulu demand and the sum of Oahu and neighbor island supply.

[1] A detailed discussion of the statistical form of the estimated functions is available in Renaud (*1*). Since publication of the Renaud study, population estimates upon which it was based have been revised and more recent information has become available resulting in the need for this study. The present study can be viewed as an updating and expansion of the projections portion of the earlier work.

[2] The functions are estimated from price and quantity data published in *Statistics of Hawaiian Agriculture*, Hawaii Crop and Livestock Reporting Service, 1972 and *Honolulu Unloads*, Federal-State Market News Service, 1972. Other supporting data are from *The Data Book*, published by the Department of Planning and Economic Development, State of Hawaii, 1972.

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The total Honolulu market supply is the sum of the Oahu-grown supply and neighbor island supplies and imports.

Figures 1 through 8 show the actual and estimated production of each crop on Oahu during the study period. These graphs can also be viewed as indicative of the ability of the estimated functions to represent actual production and demand levels.

Snap Beans

Oahu produced 53 percent of the Honolulu snap bean supply in 1971. From a 1953 peak of nearly 1.6 million pounds, Oahu production declined to about .4 million pounds by 1971. Consumption levels are predicted to decline significantly over the next decade reaching .1 pounds by 1980. Per capita U.S. Mainland consumption in 1969 was 1.8 pounds, while Honolulu consumption was only 1.3 pounds. The supply functions for Oahu predict declining Oahu production to a level of 10 acres in the late 1970s. The outer island supply to Honolulu, although responsive to price, is expected to rise only slightly by 1975. Demand appears to be a limiting factor beyond 1975. Figure 1 compares the actual and estimated Oahu production during the study period. Table 1 contains the projected values of the market components.

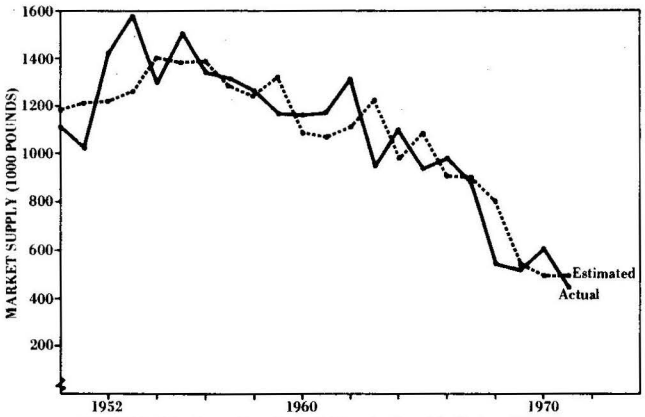

FIGURE 1. Oahu-Grown Snap Beans Sold on the Honolulu Market, 1950-71.

Cucumbers

Oahu supplied only about one-fourth of the Honolulu demand for cucumbers in 1971. Cucumber production on Oahu has varied cyclically around a declining trend peaking in 1955 (1.9 million pounds) and 1964 (1.6 million pounds). Production in 1971 was about .8 million pounds. Honolulu consumption of cucumbers has historically been higher than that of the U.S. Mainland, but it is predicted to decline from 5 pounds in 1971 to about 4 pounds by the late 1970s. This compares to a U.S. consumption in 1969 of 3.4 pounds per capita. Figure 2 compares actual and estimated cucumber production on Oahu during the study period. Table 2 contains the market projections to 1980.

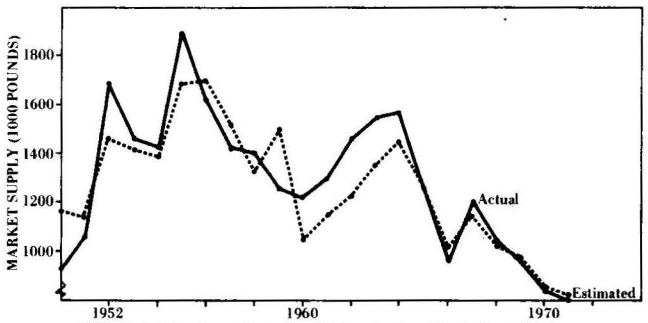

FIGURE 2. Oahu-Grown Cucumbers Sold on the Honolulu Market, 1950-71.

Green Onions

Eighty-eight percent of the Honolulu green onion supply was Oahu grown in 1971. Oahu production has fluctuated between .6 and .8 million pounds since peaking at .9 million pounds in 1962.

The estimated demand equation predicts a 1.65 pound per capita consumption in 1972, rising thereafter by .15 pound per year. Because consumption has remained at about 1.4 pounds per capita for the past 20 years the function values are probably overly optimistic. The 1972 level of per capita consumption is assumed through 1980. Figure 3 compares actual and predicted Oahu production during the study period. Table 3 contains the projections.

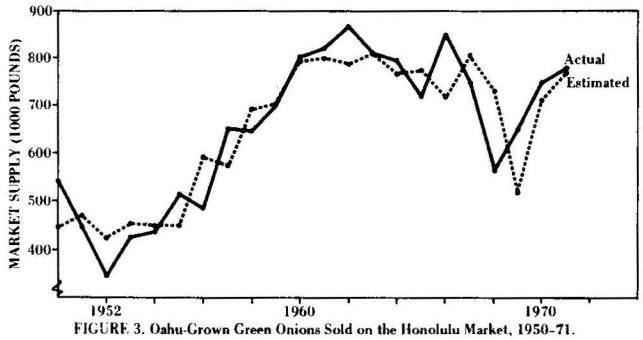

FIGURE 3. Oahu-Grown Green Onions Sold on the Honolulu Market, 1950-71.

Green Peppers

In terms of total Honolulu market supply, Oahu is a minor producer of green peppers and supplied only 16 percent of the market in 1971. The highest level of Oahu production during the study period was 1962 when .6 million pounds were produced. Since 1962 production has

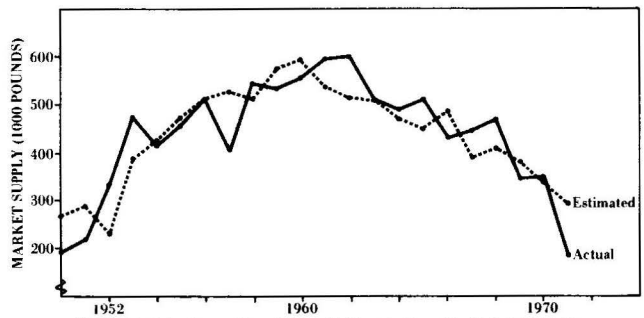

FIGURE 4. Oahu-Grown Green Peppers Sold on the Honolulu Market, 1950-71.

fallen off somewhat irregularly. Production in 1971 was less than .2 million pounds. Honolulu consumption of peppers is substantially below that of the U.S. Mainland, which was 2.6 pounds per capita in 1969; Honolulu per capita consumption is estimated at 1.73 pounds for 1972 and is expected to decline slightly to 1.63 pounds by 1975. Figure 4 compares actual and estimated Oahu production during the study period. Table 4 contains the projections.

Tomatoes

In broad terms, the Hawaii share of the Honolulu tomato market has fallen from about two-thirds in the early 1960s to one-third in the early 1970s. Oahu produced only 2 percent of the Honolulu market supply in 1971. In absolute terms production fell from 3.4 million pounds in the late 1950s to below .2 million pounds in 1971. The estimated supply function for Oahu predicts production levels in 1971, 1972, and 1973 approximately equal to 10 acres harvested, which is considered a minimum. Rapidly rising production levels are expected in subsequent years, reaching nearly 1.7 million pounds for 1980. Covered tomato production, a technological innovation now appearing in Hawaii, could significantly change production trends. A preliminary survey conducted by the Hawaii Cooperative Extension Service in early 1973 indicated plans for the production of 7 acres of covered tomatoes in the near future. About one-half of this area is scheduled for Oahu. Potentially this acreage could produce over 9 million pounds of tomatoes and result in State self-sufficiency. These estimates are not included in the projections because the economic viability has not yet been demonstrated and because perhaps 50 percent of the production will be sold without passing through established market channels. As this new trend is established the projections will be modified. Table 5 contains projections of the different supply-demand components. Figure 5 compares the estimated and actual or observed Oahu production values during the study period.

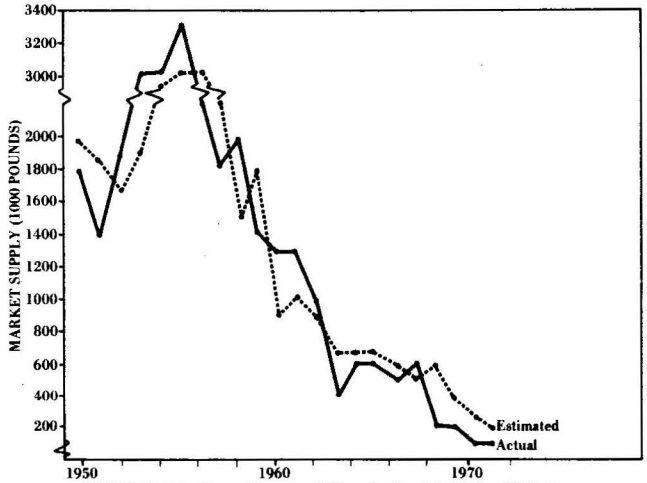

FIGURE 5. Oahu-Grown Tomatoes Sold on the Honolulu Market, 1950-71.

Papayas

Oahu papaya growers supplied about 18 percent of the Honolulu market in 1971, and outer island producers supplied the remaining 82 percent. The sum of the two estimated supply functions equals market demand and a separate demand function was not estimated. Oahu production of papayas declined steadily during the study period reaching 1.2 million in 1971. The projected Oahu, and consequently the outer island, shares of the market do not reflect the production of significant new plantings on Oahu. As data become available which incorporate this production, the projections will be revised. Per capita consumption is predicted to decline from 17.58 pounds in 1971 to 16.26 pounds by 1975. Beyond 1975, the 16.26-pound-per-capita consumption level is assumed. Figure 6 compares the actual and estimated Oahu production during the study period. Table 6 contains the projections.

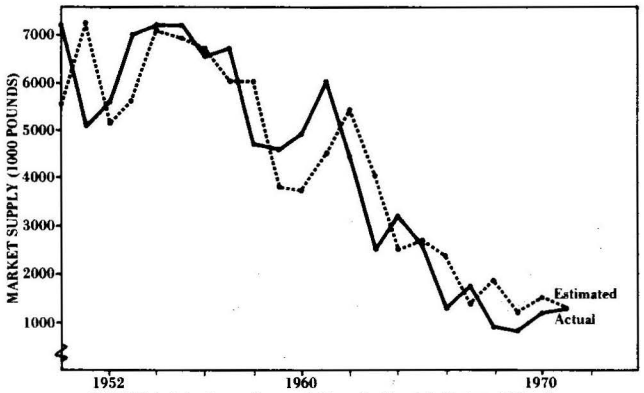

FIGURE 6. Oahu-Grown Papayas Sold on the Honolulu Market, 1950-71.

Bananas

In 1971, Oahu produced 43 percent of the Honolulu banana supply, and per capita consumption was 11.23 pounds, about half the U.S. average. Oahu banana production declined from nearly 7 million pounds in 1953 to 4 million in 1971. During the past 4 years, however, production appears to have stabilized somewhat, and this fact is reflected in the projections. Consumption is predicted by the estimated equation to decline to about 6.5 pounds by 1980; however, because this equation is only marginally significant, the 1973-74 predicted level of

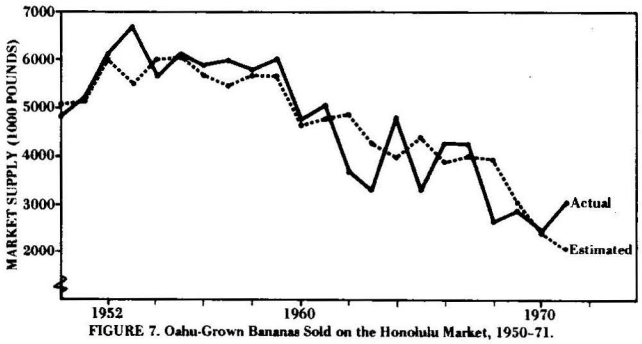

FIGURE 7. Oahu-Grown Bananas Sold on the Honolulu Market, 1950-71.

consumption, 9.5 pounds per capita, is assumed beyond 1974. The poor results obtained from the demand function result from the erratic fluctuations in the market during the past several years when, on occasion, consumption has shifted by as much as 50 to 100 percent in a single year. Figure 7 compares actual and estimated Oahu supply during the study period. Table 7 contains the projections.

Statistical Summary

The statistical forms of the equations employed in this paper are discussed in detail by Renaud (*1*). A Nerlove supply model containing a variable defined as the ratio of farm-to-contract construction wage levels is used for the supply projections. Demand projections are based on the special case of the Houthakker-Taylor model in which the coefficient for the change in per capita income (ΔY_t) is not significantly different from the coefficient for lagged income (Y_{t-1}), as discussed in Renaud (*1*, p. 20). The estimated equations and related significance tests are listed in Tables 8, 9, and 10.

Reference

(1) Renaud, Bertrand M. *The Impact of Economic Growth on the Agricultural Trade Structure of an Island Economy.* HAES Research Bulletin 150. August 1971.

Table 1. Snap beans: Supply-demand projections, Honolulu, 1972–80

Projection	Year				
	1972	1973	1974	1975	1980
Honolulu per capita demand (pounds)	1.3	1.2	1.1	1.0	.1
Honolulu total demand (1000 pounds)[1]	780	760	710	640	90
Honolulu supply originating on Oahu (1000 pounds)	470	460	450	440	90[2]
Honolulu supply originating on outer islands (1000 pounds)	120	120	120	120	–
Imports to Honolulu (1000 pounds)[3]	180	180	140	80	–
Honolulu wholesale price (cents/pound)[4]	47.5	47.5	47.5	47.5	52.4
Estimated population (1000)[1]	615	632	649	666	758

[1]Based on Honolulu de facto population estimates which include tourists present but exclude residents temporarily absent.
[2]Production from 10 acres assumed.
[3]Calculated as the difference between Honolulu demand and the sum of Oahu and outer island supply.
[4]1971 price level assumed to 1974, rising thereafter.

Table 2. Cucumbers: Supply-demand projections, Honolulu, 1972–80

Projection	Year				
	1972	1973	1974	1975	1980
Honolulu per capita demand (pounds)	4.9	4.7	4.6	4.4	3.7
Honolulu total demand (1000 pounds)[1]	3030	3000	2970	2950	2820
Honolulu supply originating on Oahu (1000 pounds)	880	910	930	950	1000
Honolulu supply originating on outer islands (1000 pounds)	1890	1860	1840	1840	1820
Imports to Honolulu (1000 pounds)[2]	260	230	200	160	–
Honolulu wholesale price (cents/pound)	22.0	22.5	23.0	23.4	25.8
Estimated population (1000)[1]	615	632	649	666	758

[1]Based on Honolulu de facto population estimates which include visitors present but exclude residents temporarily absent.
[2]Calculated as the difference between Honolulu demand and the sum of Oahu and outer island supply.

Table 3. Green onions: Supply-demand projections, Honolulu, 1972–80

Projection	Year				
	1972	1973	1974	1975	1980
Honolulu per capita demand (pounds)	1.7	1.7	1.7	1.7	1.7
Honolulu total demand (1000 pounds)[1]	1020	1040	1070	1100	1250
Honolulu supply originating on Oahu (1000 pounds)	760	760	750	750	730
Honolulu supply originating on outer islands (1000 pounds)[2]	–	–	–	–	–
Imports to Honolulu (1000 pounds)[3]	260	280	320	350	520
Honolulu wholesale price (cents/pound)	33.1	34.2	35.3	36.4	41.8
Estimated population (1000)[1]	615	632	649	666	758

[1]Based on Honolulu de facto population estimates which include visitors present but exclude residents temporarily absent.
[2]Less than 10 acres production.
[3]Calculated as the difference between Honolulu demand and the sum of Oahu and outer island supply.

Table 4. Green peppers: Supply-demand projections, Honolulu, 1972–80

Projection	Year				
	1972	1973	1974	1975	1980
Honolulu per capita demand (pounds)	1.7	1.7	1.7	1.6	1.5
Honolulu total supply (1000 pounds)[1]	1060	1070	1080	1090	1140
Honolulu supply originating on Oahu (1000 pounds)	360	370	370	360	320
Honolulu supply originating on outer islands (1000 pounds)	230	220	220	210	170
Import to Honolulu (1000 pounds)[2]	470	480	490	520	650
Honolulu wholesale price (cents/pound)	28.3	28.8	29.2	29.6	31.7
Estimated population (1000)[1]	615	632	649	666	758

[1]Based on Honolulu de facto population estimates which include visitors present but exclude residents temporarily absent.
[2]Calculated as the difference between Honolulu demand and the sum of Oahu and outer island supply.

Table 5. Tomatoes: Supply-demand projections, Honolulu, 1972–80

Projection	Year				
	1972	1973	1974	1975	1980
Honolulu per capita demand (pounds)	14.4	14.4	14.5	14.4	14.0
Honolulu total demand (1000 pounds)[1]	8860	9130	9380	9620	10630
Honolulu supply originating on Oahu (1000 pounds)	240	320	430	570	1680
Honolulu supply originating on outer islands (1000 pounds)	3850	3800	3760	3740	3680
Imports to Honolulu (1000 pounds)[2]	4770	5010	5190	5310	5270
Honolulu wholesale price (cents/pound)	24.8	25.2	25.7	26.2	28.6
Estimated population (1000)[1]	615	632	649	666	758

[1]Based on Honolulu de facto population estimates which include visitors present but exclude residents temporarily absent.
[2]Calculated as the difference between Honolulu demand and the sum of Oahu and outer island supply.

Table 6. Papayas: Supply-demand projections, Honolulu, 1972–80

Projection	Year				
	1972	1973	1974	1975	1980
Honolulu per capita demand (pounds)[1]	17.0	16.6	16.4	16.3	16.3
Honolulu total demand (1000 pounds)	10450	10490	10620	10830	12320
Honolulu supply originating on Oahu (1000 pounds)	1450	1610	1810	2040	2040
Honolulu supply originating on outer islands (1000 pounds)	9000	8880	8810	8790	10280
Honolulu wholesale price (cents/pound)	13.0	13.3	13.7	14.0	15.8
Estimated population (1000)[1]	615	632	649	666	758

[1]Calculated from the sum of supply projections divided by Honolulu de facto population estimates which include visitors present but exclude residents temporarily absent.

Table 7. Bananas: Supply-demand projections, Honolulu, 1972–80

Projection	Year				
	1972	1973	1974	1975	1980
Honolulu per capita demand (pounds)	9.9	9.6	9.5	9.5	9.5
Honolulu total demand (1000 pounds)[1]	6080	6060	6170	6330	7200
Honolulu supply originating on Oahu (1000 pounds)	3000	3100	3050	2950	2380
Honolulu supply originating on outer islands (1000 pounds)	1330	1350	1340	1320	1060
Imports to Honolulu (1000 pounds)[2]	1750	1610	1780	2060	3760
Honolulu wholesale price (cents/pound)	12.2	12.5	12.8	13.1	14.6
Estimated population (1000)[1]	615	632	649	666	758

[1]Calculated from Honolulu de facto projection estimates which include visitors present but exclude residents temporarily absent.
[2]Calculated as the difference between Honolulu demand and the sum of Oahu and outer island supply.

Table 8. Supply functions for Oahu growers selling on the Honolulu market

Crop	R^2	F	Regression coefficients[1]			
			a	Q_{t-1}	P_{t-1}	L_{t-1}
Snap beans	.76	19.03	825.67	.47	-14.15	132.77
				(.35)[2]	(11.93)	(411.05)
Cucumbers	.61	9.55	-328.43	.73	3.33	866.45
				(.22)	(19.55)	(413.04)
Green onions	.81	25.16	636.98	.60	-1.58	-474.68
				(.13)	(2.37)	(170.29)
Green peppers	.70	13.98	854.73	.31	-14.02	-326.04
				(.22)	(4.12)	(155.90)
Tomatoes	.85	33.23	-2393.83	.99	61.14	1606.58
				(.17)	(46.73)	(824.86)
Papayas	.80	23.92	-2907.43	.94	113.78	2813.33
				(.19)	(150.91)	(2168.15)
Bananas	.72	15.39	4793.21	.25	-284.89	1722.30
				(.29)	(162.29)	(1322.02)

[1]a = intercept; Q_{t-1} = lagged total quantity marketed (1000 pounds); P_{t-1} = lagged Honolulu wholesale price (cents/pound); and L_{t-1} = lagged ratio of farm-to-contract construction wages.
[2]Values in parentheses are standard errors.

Table 9. Supply functions for neighbor island growers selling on the Honolulu market

Crop	R^2	F	Regression coefficients[1]			
			a	Q_{t-1}	P_{t-1}	I_{t-1}
Snap beans	.69	13.62	-89.29	-.02	2.70	147.43
				(.07)[2]	(.44)	(30.63)
Cucumbers	.64	10.88	885.74	.45	20.40	-563.66
				(.21)	(17.45)	(405.93)
Green onions	.54	7.13	-8.87	-.16	.64	5.31
				(.23)	(.19)	(7.90)
Green peppers	.64	10.79	235.95	.68	-4.64	-64.98
				(.18)	(3.35)	(138.20)
Tomatoes	.75	18.42	1757.14	.74	1.26	-1396.89
				(.16)	(45.52)	(1338.14)
Papayas	.78	20.80	2704.53	.75	77.66	-2642.14
				(.16)	(192.76)	(4846.18)
Bananas	.81	26.16	1727.27	.84	-54.21	-1399.53
				(.12)	(61.83)	(1035.40)

[1]Identical in form to functions in Table 8 except that neighbor island sales in Honolulu are estimated.
[2]Values in parentheses are standard errors.

Table 10. Honolulu market per capita demand[1]

Crop[3]	R^2	F	Regression coefficients[2]			
			a	Q_{t-1}	Y_t	P_t
Snap beans	.86	56.65	2.04	.62	-.0004	
				(.20)[4]	(.0002)	
Cucumbers	.55	11.45	3.84	.38	-.0004	
				(.22)	(.0002)	
Green onions	.59	8.65	.05	.76	.0002	-.013
				(.16)	(.00009)	(.006)
Green peppers	.56	12.04	.78	.62	-.00007	
				(.17)	(.00004)	
Tomatoes	.37	5.51	3.47	.67	.00002	
				(.20)	(.0002)	
Bananas	.39	6.13	16.05	-.05	-.002	
				(.26)	(.0007)	

[1]A historical de facto population series does not exist for Honolulu; consequently, State de facto population estimates were used in calculating the functions. The per capita projections given in Tables 1, 2, and 3 are stated in terms of Oahu de facto population estimates.
[2]a = intercept; Q_{t-1} = lagged per capita consumption (pounds); Y_t = real per capita personal income (dollars); and P_t = Honolulu wholesale price (cents/pound).
[3]A papaya demand equation was not estimated because Oahu and neighbor island growers supply the entire market.
[4]Values in parentheses are standard errors.

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